(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number
WO 01/40765 A3

(51) International Patent Classification[7]: G01N 15/14

(21) International Application Number: PCT/US00/42350

(22) International Filing Date:
29 November 2000 (29.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/454,488 3 December 1999 (03.12.1999) US

(71) Applicant *(for all designated States except US)*: **XY, INC.** [US/US]; 1108 North Lemay Avenue, Fort Collins, CO 80524 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **BUCHANAN, Kristopher, S.** [US/US]; Xy, Inc., 3801 Rampart Road, ARBL Building, Fort Collins, CO 80523 (US). **HERICKHOFF, Lisa** [US/US]; Xy, Inc., 3801 Rampart Road, ARBL Building, Fort Collins, CO 80523 (US).

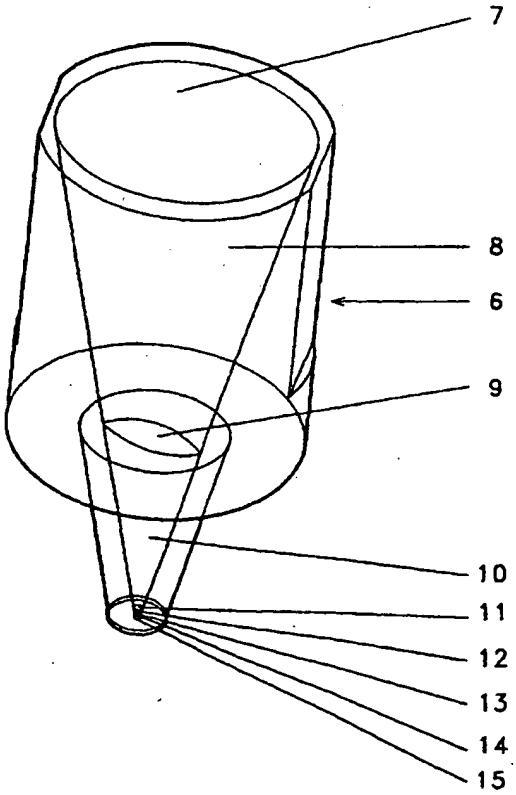
(74) Agent: **SANTANGELO, Luke**; Santangelo Law Offices, P.C., Third floor, 125 South Howes, Fort Collins, CO 80521 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian

[Continued on next page]

(54) Title: IMPROVED FLOW CYTOMETER NOZZLE AND FLOW CYTOMETER SAMPLE HANDLING METHODS



(57) Abstract: An improved nozzle system for a flow cytometer and accompanying methods have been invented for a high efficiency orientation and sorting process of a flat sample and dedicates items such as equine or bovine sperm cells. This improved nozzle system comprises a nozzle (16) with a novel interior surface geometry that can both gently accelerate the cells and can include an elliptical-like, single torsional interior surface element within (c) the nozzle, i.e., a single torsional orientation nozzle (6). The elliptical-like, single torsional interior surface element (e.g.) (8, 9, 10) may have a laminar flow surface and may produce the simplest flow path for applying minimal forces which act in either an accelerative nature or orienting hydrodynamic forces, namely, the single torsional orientation forces, to orient a flat sample (16) such as animal sperm cells into a proper direction for an analyzing and efficiently sorting process in clinical use, for research and for the animal insemination industry.

WO 01/40765 A3

patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
14 February 2002

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

Ir national Application No
PCT/US 00/42350

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01N15/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, INSPEC, COMPENDEX, SCISEARCH, PAJ, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 3 893 766 A (HOGG WALTER R) 8 July 1975 (1975-07-08) column 2, line 27-34 column 3, line 4-60 column 4, line 18-38 --- -/--	1-3, 70-72 48-51 4-13, 18-47, 52, 55-65, 73-86, 89-141, 144-159, 162-178

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 September 2001	09/10/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Zinngrebe, U

2

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/42350

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 05504 A (US AGRICULTURE) 4 February 1999 (1999-02-04) cited in the application	14-17, 53,54, 66-69, 87,88, 142,143, 160,161, 173,180
Y	page 3, paragraph 3 page 5, paragraph 2 -page 8, paragraph 2	48-51
A	US 5 088 816 A (TOMIOKA ATUO ET AL) 18 February 1992 (1992-02-18) column 1, line 52-64; figures 7,11-13 column 8, line 23-27 column 8, line 64 -column 9, line 39	1
A	EP 0 288 029 A (HITACHI LTD) 26 October 1988 (1988-10-26) column 7, line 46 -column 8, line 32	1
A	JOHNSON L A ET AL: "SEX PRESELECTION: HIGH-SPEED FLOW CYTOMETRIC SORTING OF X AND Y SPERM FOR MAXIMUM EFFICIENCY" THERIOGENOLOGY, LOS ALTOS, CA, US, vol. 52, no. 8, 1999, pages 1323-1341, XP001025636 ISSN: 0093-691X page 1329	1

2

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Ir ational Application No
PCT/US 00/42350

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 3893766	A	08-07-1975	US	RE29141 E	22-02-1977
WO 9905504	A	04-02-1999	US	5985216 A	16-11-1999
			AU	8662998 A	16-02-1999
			BR	9810803 A	12-09-2000
			CN	1265195 T	30-08-2000
			EP	0998672 A2	10-05-2000
			WO	9905504 A2	04-02-1999
US 5088816	A	18-02-1992	JP	2808321 B2	08-10-1998
			JP	3105235 A	02-05-1991
			US	RE35227 E	07-05-1996
EP 0288029	A	26-10-1988	JP	1868870 C	06-09-1994
			JP	5075352 B	20-10-1993
			JP	63262565 A	28-10-1988
			DE	3886980 D1	24-02-1994
			DE	3886980 T2	01-06-1994
			EP	0288029 A2	26-10-1988
			US	5007732 A	16-04-1991